GEORGE BRUCE HALSTED.

By FLORIAN CAJORI, University of California.

[For several years the MONTHLY has had no leading article concerning a deceased mathematician. An exception is now made in the case of one who in its earlier years assisted very materially in the financial support of the MONTHLY, and contributed extensively to its pages.

Dr. Halsted's articles in the MONTHLY were over fifty in number, and one of them, "Non-euclidean geometry, historical and expository," consisting chiefly of his translation of Saccheri's *Euclides Vindicatus*, extended as a serial through the first five volumes. Twenty of the articles were biographical sketches, usually accompanied by portraits, in the series which Professor Finkel established and carried on for a number of years. These sketches were as follows: Alasia (volume 9), Barbarin (15), Beltrami (9), Bolyai Farkas (3), Cayley (2), De Morgan (4), Frost (6), Höuel (4), Klein (1), Lambert (2), Lie (6), Lobachevsky (2), F. Schmidt (8), D. M. Y. Sommerville (19), Sylvester (1 and 4), Tchebychev (2 and 5), Tucker (7), and Vasiliev (4). Most of Dr. Halsted's other articles dealt with topics of non-euclidean geometry or the foundations of geometry.

An appreciative sketch of Dr. Halsted, by Professor L. E. Dickson, appeared in the first volume of this MONTHLY, *1894*, 337–340; another by C. Alasia may be found in *Le Matematiche*, Città di Castello, volume 2; and others in B. F. Finkel's *Mathematical Solution Book*, fourth edition, 1902, and in *National Cyclopædia of American Biography*, volume 3, new edition. The first three are accompanied by portraits. Halsted was the first student in mathematics at the Johns Hopkins University and his insistence on a course in the theory of algebraic forms started the brilliant investigations that characterized Sylvester's work in Baltimore. This is related in Cajori's *Teaching and History of Mathematics in the United States*, 1890, pp. 264–266. We have already indicated the leading facts of Dr. Halsted's life (*1922*, 187); see also this issue of the MONTHLY, page 352. A fairly complete list of his writings may be derived from: Sommerville's *Bibliography of Non-Euclidean Geometry*, 1911; Poggendorff's *Biographisches-literarisches Handwörterbuch*, 1898 and 1904; and the Royal Society's *Catalogue of Scientific Papers*, volumes 10 and 15—EDITORS.]

On March 19, 1922, there passed away in New York City, at the age of sixty-nine years, a unique and picturesque figure among American mathematicians. One of the earliest pupils of J. J. Sylvester at the Johns Hopkins University, a student in Germany and an instructor at Princeton University, he was later for nineteen years professor of mathematics at the University of Texas. Leaving Texas in 1903 he was for nine years successively connected with several institutions, passing rapidly from one to another. His closing years were spent with a son at Greeley, Colorado.

Halsted's scientific activity may be said to have penetrated three fields: (1)

the translation, with commentaries, of noted foreign works, particularly of the great researches of Lobachevsky, Bolyai and Saccheri, and some of the popular writings of Poincaré; (2) studies in the logic of mathematics, particularly of geometry; (3) criticisms of the mathematical text-books of his day.

American mathematicians are indebted to Halsted for making the writings of the creators of non-Euclidean geometry accessible to them in the English language. His commentaries were always spicy and valuable, even though, as a historian, Halsted was not always able to maintain the attitude of an impartial judge. At his hands Gauss, for instance, received scant justice.

The most conspicuous of his efforts in logic was his *Rational Geometry*, the first edition of which, published in 1904, was based on David Hilbert's set of axioms of 1898. The book was widely and favorably reviewed, both in this country and abroad. Certain logical defects were pointed out, which caused Halsted to prepare a revised edition (1907) in which the words on the title-page of the first edition, "Based on Hilbert's Foundations," were dropped. This revised edition was well received and was translated into several foreign languages. Logical precision was the dominant motive in the preparation also of his earlier texts, chief of which are his *Elements of Geometry* (1885) and *Synthetic Projective Geometry* (1906).

Among critics Halsted ranked as the most outspoken American opponent of slip-shod methods of reasoning, such, for example, as occurred in the same-direction theory of parallel lines and in the unrestricted employment of hypothetical constructions. Perhaps rather over-confident of the correctness of his own views, his criticisms of mathematical writers, and sometimes also of university administrators, were at times so violent as to recoil upon himself. Nevertheless, his influence upon the teaching of mathematics in this country has been decidedly beneficial. Several of our most active mathematicians of the present time received inspiration while they were pupils of Halsted.

I myself met Halsted in person only two or three times at scientific meetings and then, each time, only for a few moments. But I was in occasional correspondence with him since 1888. When I first entered upon historical work, I received from him valuable suggestions and much-needed encouragement. About 1895 he read the geometrical part of the manuscript of my *History of Elementary Mathematics*. In a letter to me he made a most unsparing attack, called forth by one of my criticisms of Euclid's logic and a clerical error that I had made in copying a reference to Euclid. In my reply, I acknowledged the clerical error, and made a few changes and additions to my account of Euclid. I also endeavored to point out to him the slight unreasonableness of his attack. By return mail I received an answer, which indicated that the storm had passed and that Halsted had fully re-entered the atmosphere of serene cordiality. He did not indulge in flattery; his criticisms were honest and based on a firm grasp of fundamentals; his correspondence was stimulating.

Halsted had in his private library some rare books which he prized highly. He himself has published statements relating to his copy of Saccheri. His copy

of the first (1637) edition of Descartes' *Géométrie*, which, through the courtesy of Professor C. I. Palmer, the present writer examined two years ago, contained on the first leaf the signature of Letenneur and the following inscription:

"Offert à Monsieur J. J. Sylvester Souvenir affectioné de son dévoué Chasles. Feb. 1847."

Further on appears the entry:

"To Dr. Halsted, with the kind regards and all good wishes of J. J. Sylvester."
2d May 1893.

And at the end of the book is pasted a small sheet containing the following note written by Halsted himself:

"This book, *La Geometrie*, treasured in the family of Letenneur as gift of the author and by the great geometer and historian of geometry M. Chasles as the gem of his collection, was given by him to Sylvester as recompense for a great service and by Sylvester to his favorite pupil Halsted, by whom it was conveyed to Professor C. I. Palmer.
"The signature of Letenneur with his minute but characteristic rubric, that of Chasles after his glowing words and of Sylvester after his gracious lines
                    Make the book priceless.
   G. B. H."

The spirit of Halsted has fled—gone to meet face to face the great masters he admired—Saccheri, Lobachevsky, Bolyai.

AMONG MY AUTOGRAPHS.

By DAVID EUGENE SMITH, Columbia University.

28. DE MOIVRE EXPRESSES HIMSELF.

Of all the mathematicians who added to the reputation of England in the closing years of Newton's life, no one arouses a more sympathetic interest than Abraham De Moivre, author of the well-known *Doctrine of Chances*,[1] of the even

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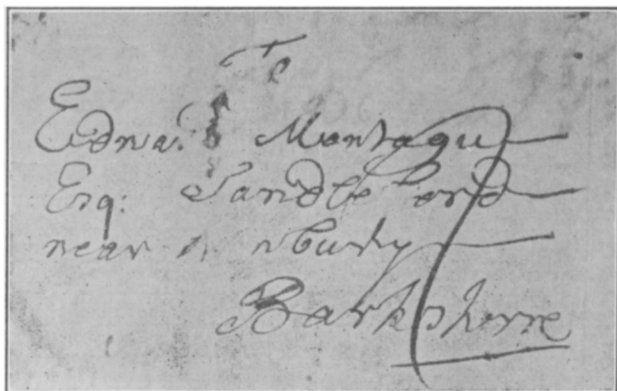
[1] London, 1718; second edition, London, 1738; third edition, posthumous, 1756.